WHAT IS CLAIMED IS:

1. An external programmer device for programming pacing parameters of an implanted cardiac pacing device for providing pacing to the heart of a patient in which the pacing device is implanted, comprising:

(a) a transmitter for transmitting programming instructions from the programmer device to the implanted cardiac pacing device to program pacing parameters of the implanted cardiac pacing device;

(b) a finger plethysmogram signal detector for providing a finger plethysmogram signal when attached to a finger of the patient in which the cardiac pacing device is implanted; and

(c) a programmer processor coupled to the transmitter and the finger detector and programmed to process the finger plethysmogram signal, to generate programming instructions for programming the pacing parameters of the implanted cardiac pacing device, and to control the transmitter for transmitting the programming instructions to the implanted cardiac pacing device.

2. The external programmer device of Claim 1 wherein the finger plethysmogram signal detector is a finger clip signal detector.

3. The external programmer device of Claim 1 wherein the finger plethysmogram signal detector is a photoplethysmogram signal detector.

4. The external programmer device of Claim 3 wherein the finger plethysmogram signal detector is a pulse oximeter sensor.

5. The external programmer device of Claim 1 comprising additionally a finger plethysmogram signal amplifier, a finger

plethysmogram signal filter, and an analog-to-digital converter for converting an analog finger plethysmogram signal into a digital finger plethysmogram signal, for coupling the finger plethysmogram signal detector to the programmer processor.

6. The external programmer device of Claim 1 wherein the programmer processor is implemented at least partially in at least one microprocessor.

7. The external programmer device of Claim 1 comprising additionally a display coupled to the programmer processor for displaying a representation of the processed finger plethysmogram signal.

8. The external programmer device of Claim 1 wherein the programmer processor is programmed to process the finger plethysmogram signal to detect pulsus alternans in the finger plethysmogram signal and to derive a quantitative value related to the degree of pulsus alternans detected in the finger plethysmogram signal.

9. The external programmer device of Claim 1 wherein the programmer processor is programmed to generate programming instructions to be transmitted to the implanted cardiac pacing device to control the implanted cardiac pacing device to pace the heart for a plurality of series of paced beats using different selected pacing parameter values for different series of paced beats, to analyze a selected characteristic of the finger plethysmogram signal during each series of paced beats, and to determine an optimum pacing parameter value as the pacing parameter value resulting in the best finger plethysmogram signal characteristics analyzed during a series of paced beats.

10. The external programmer device of Claim 9 wherein the selected pacing parameter value is a selected value of a pacing parameter selected from the group of pacing parameters consisting of: AV delay, interventricular delay, pacing energy, pacing amplitude, pacing pulse width, pacing site, pacing mode, and pacing chamber.

11. The external programmer device of Claim 9 wherein the programmer processor is programmed to analyze a selected characteristic of the finger plethysmogram signal during each series of paced beats which is selected from the group of finger plethysmogram signal characteristics consisting of a pulse amplitude response and a degree of pulsus alternans as detected in the finger plethysmogram signal.

12. The external programmer device of Claim 9 wherein the programmer processor is programmed to generate programming instructions to be transmitted to the implanted cardiac pacing device to control the implanted cardiac pacing device to pace the heart for a plurality of series of paced beats separated by non-paced beats.

13. The external programmer device of Claim 12 wherein the programmer processor is programmed to analyze characteristics of the finger plethysmogram signal during the paced beats in each series of paced beats and during non-paced beats before and after each series of paced beats and to use the characteristics of the finger plethysmogram signal during the paced and non-paced beats to reduce noncardiogenic effects on the finger plethysmogram signal.

14. An external programmer device for programming pacing parameters of an implanted cardiac pacing device for providing

pacing to the heart of a patient in which the pacing device is implanted, comprising:

(a) a transmitter for transmitting programming instructions from the programmer device to the implanted cardiac pacing device to program pacing parameters of the implanted cardiac pacing device;

(b) a finger plethysmogram signal detector for providing a finger plethysmogram signal when attached to a finger of the patient in which the cardiac pacing device is implanted;

(c) a mouthpiece adapted for performance of a Valsalva maneuver by the patient;

(d) a pressure sensor coupled to the mouthpiece to provide a pressure signal relative to pressure in the mouthpiece during performance of the Valsalva maneuver by the patient; and

(e) a programmer processor coupled to the transmitter and the finger detector and the pressure sensor and programmed to monitor performance of the Valsalva maneuver from the pressure signal, to process the finger plethysmogram signal during performance of the Valsalva maneuver, to generate programming instructions for programming the pacing parameters of the implanted cardiac pacing device, and to control the transmitter for transmitting the programming instructions to the implanted cardiac pacing device.

15. The external programmer device of Claim 14 wherein the finger plethysmogram signal detector is a finger clip signal detector.

16. The external programmer device of Claim 14 wherein the finger plethysmogram signal detector is a photoplethysmogram signal detector.

17. The external programmer device of Claim 16 wherein the finger plethysmogram signal detector is a pulse oximeter sensor.

18. The external programmer device of Claim 14 comprising additionally a finger plethysmogram signal amplifier, a finger plethysmogram signal filter, and an analog-to-digital converter for converting an analog finger plethysmogram signal into a digital finger plethysmogram signal, for coupling the finger plethysmogram signal detector to the programmer processor.

19. The external programmer device of Claim 14 wherein the pressure sensor is a pressure transducer for producing an analog pressure signal relative to the pressure level in the mouthpiece and comprising additionally an analog-to-digital converter for converting the analog pressure signal relative to the pressure level in the mouthpiece to a digital pressure signal relative to the pressure level in the mouthpiece for coupling the pressure sensor to the programmer processor.

20. The external programmer device of Claim 14 comprising additionally a mechanical device for displaying a representation of the mouthpiece pressure level to the patient.

21. The external programmer device of Claim 14 wherein the programmer processor is implemented at least partially in at least one microprocessor.

22. The external programmer device of Claim 14 comprising additionally a display coupled to the programmer processor for displaying a representation of the processed finger plethysmogram signal during performance of the Valsalva maneuver.

23. The external programmer device of Claim 14 wherein the programmer processor is programmed to derive a quantitative value related to a filling pressure selected from the group of filling pressures consisting of pulmonary-capillary wedge pressure and left ventricular diastolic pressure from the finger plethysmogram signal processed during performance of the Valsalva maneuver by the patient.

24. A non-invasive method of optimizing pacing parameters of a cardiac device implanted in a patient, comprising the steps of:

(a) detecting a finger plethysmogram signal from a patient during pacing with a selected pacing parameter value;

(b) analyzing the finger plethysmogram signal to obtain a cardiac performance parameter indicative of cardiac performance therefrom;

(c) adjusting the selected pacing parameter value of the implanted cardiac device; and

(d) obtaining an improvement in the cardiac performance parameter by repeating steps (a) – (c) to obtain a selected pacing parameter value which results in an improved cardiac performance parameter.

25. The method of Claim 24 wherein the step of detecting a finger plethysmogram signal from a patient includes the step of attaching a finger plethysmogram detector to a finger of the patient.

26. The method of Claim 25 wherein the step of attaching a finger plethysmogram detector to a finger of the patient includes the step of attaching a photoplethysmogram signal detector to a finger of the patient.

27. The method of Claim 26 wherein the step of attaching a finger plethysmogram detector to a finger of the patient includes the step of attaching a pulse oximeter sensor to a finger of the patient.

28. The method of Claim 24 comprising additionally the step of monitoring a Valsalva maneuver performed by the patient while detecting the finger plethysmogram signal.

29. The method of Claim 28 wherein the step of analyzing the finger plethysmogram signal to obtain a cardiac performance parameter indicative of cardiac performance includes the step of analyzing the finger plethysmogram signal during performance of the Valsalva maneuver by the patient to obtain a cardiac performance parameter related to a filling pressure selected from the group of filling pressures consisting of pulmonary-capillary wedge pressure and left ventricular diastolic pressure.

30. The method of Claim 24 wherein the step of analyzing the finger plethysmogram signal to obtain a cardiac performance parameter indicative of cardiac performance includes the step of displaying a representation of the finger plethysmogram signal to obtain a qualitative indication of cardiac performance.

31. The method of Claim 24 wherein the step of analyzing the finger plethysmogram signal includes the step of analyzing the finger plethysmogram signal to monitor a degree of pulsus alternans.

32. The method of Claim 31 wherein the step of analyzing the finger plethysmogram signal to monitor a degree of pulsus alternans includes the step of determining an amplitude ratio of pulses detected in the finger plethysmogram signal.

33. The method of Claim 24 wherein the steps of adjusting a selected pacing parameter and obtaining an improvement in the cardiac performance parameter includes the step of adjusting a pacing parameter to make the peak amplitudes of pulses detected in the finger plethysmogram signal more uniform.

34. The method of Claim 24 wherein the steps of adjusting a selected pacing parameter and obtaining an improvement in the cardiac performance parameter includes the step of adjusting a pacing parameter to maximize a finger plethysmogram pulse amplitude response to pacing.

35. The method of Claim 24 wherein the step of adjusting a selected pacing parameter value includes the step of adjusting at least one pacing parameter value of a pacing parameter selected from the group of pacing parameters consisting of: AV delay, intraventricular delay, pacing energy, pacing amplitude, pacing pulse width, pacing site, pacing mode, and pacing chamber.

36. The method of Claim 24 wherein the steps of adjusting a pacing parameter and obtaining an improvement in the cardiac performance parameter includes the steps of:

(a) detecting and analyzing the finger plethysmogram signal during a plurality of pacing series intervals;

(b) adjusting the pacing parameter to a different value for different pacing series intervals; and

(c) allowing the patient's heart to beat at a non-paced rhythm for a period between each such pacing interval.

37. The method of Claim 36 comprising additionally the steps of detecting the finger plethysmogram signal during paced beats in the pacing series intervals and during non-paced intervals before and after each series of paced beats and using characteristics of the finger plethysmogram signal during the paced and non-paced beat to reduce noncardiogenic effects on the finger plethysmogram signal.

38. The method of Claim 36 comprising additionally the step of detecting and analyzing the finger plethysmogram signal during a plurality of pacing series intervals separated by non-paced intervals before adjusting the pacing parameter to a different value.

39. A non-invasive method of optimizing pacing parameters of a cardiac device implanted in a patient, comprising the steps of:

(a) detecting a photoplethysmogram signal from a patient during a plurality of pacing series intervals separated by non-paced intervals;

(b) adjusting a pacing parameter value used during the pacing series intervals to a different value for different pacing series intervals;

(c) using characteristics of the photoplethysmogram signal during paced beats in the pacing series intervals and during non-paced intervals before and after the series of paced beats to reduce noncardiogenic effects on the photoplethysmogram signal;

(d) analyzing the photoplethysmogram signal to obtain a cardiac performance parameter indicative of cardiac performance therefrom; and

(e) selecting the pacing parameter values resulting in an improved cardiac performance parameter.

40. The method of Claim 39 comprising additionally the step of detecting and analyzing the finger plethysmogram signal during a plurality of pacing series intervals separated by non-paced intervals before adjusting the pacing parameter to a different value.

41. The method of Claim 39 wherein the step of detecting a photoplethysmogram signal includes the step of attaching a finger photoplethysmogram signal detector to a finger of a patient.

42. A non-invasive method of optimizing pacing parameters of a cardiac device implanted in a patient, comprising the steps of:

(a) non-invasively detecting a signal related to cardiac pulse amplitude during a plurality of pacing series intervals;

(b) adjusting a pacing parameter value used during the pacing series intervals to a different value for different pacing series intervals; and

(c) selecting the pacing parameter value resulting in the greatest non-invasively detected pulse amplitude response to pacing.

43. The method of Claim 42 wherein the step of non-invasively detecting a signal related to cardiac pulse amplitude includes the step of attaching a finger detector to a finger of the patient to obtain a finger plethysmogram signal related to cardiac pulse amplitude.

44. A non-invasive method of optimizing pacing parameters of a cardiac device implanted in a patient, comprising the steps of:

(a) non-invasively detecting a signal related to cardiac pulse amplitude during a plurality of pacing series intervals;

(b) adjusting a pacing parameter value used during the pacing series intervals to a different value for different pacing series intervals; and

(c) selecting the pacing parameter value resulting in most reduced pulsus alternans in the non-invasively detected signal.

45. The method of Claim 44 comprising additionally the step of deriving a quantitative value related to the degree of pulsus alternans in the non-invasively detected signal.

46. The method of Claim 44 wherein the step of non-invasively detecting a signal related to cardiac pulse amplitude includes the step of attaching a finger detector to a finger of the patient to obtain a finger plethysmogram signal related to cardiac pulse amplitude.

47. A non-invasive method of optimizing pacing parameters of a cardiac device implanted in a patient; comprising the steps of:

(a) non-invasively detecting a signal related to cardiac pulse amplitude during a plurality of pacing series intervals during performance of a Valsalva maneuver by the patient;

(b) adjusting a pacing parameter value used during the pacing series intervals to a different value for different pacing series intervals; and

(c) selecting the pacing parameter value resulting in the most normal cardiac pulse amplitude response detected during performance of the Valsalva maneuver.

48. The method of Claim 47 comprising additionally the step of deriving a quantitative value related to cardiac filling pressure from

the non-invasively detected signal during performance of the Valsalva maneuver.

49. The method of Claim 47 wherein the step of non-invasively detecting a signal related to cardiac pulse amplitude includes the step of attaching a finger detector to a finger of the patient to obtain a finger plethysmogram signal related to cardiac pulse amplitude.

50. A non-invasive method of optimizing pacing parameters of a cardiac device implanted in a patient, comprising the steps of:

(a) non-invasively detecting a signal related to cardiac pulse amplitude during a plurality of pacing series intervals;

(b) adjusting a pacing parameter value used during the pacing series intervals to a different value for different pacing series intervals; and

(c) selecting the pacing parameter value resulting in the most even pulse amplitude in the non-invasively detected signal.

51. The method of Claim 50 wherein the step of non-invasively detecting a signal related to cardiac pulse amplitude includes the step of attaching a finger detector to a finger of the patient to obtain a finger plethysmogram signal related to cardiac pulse amplitude.